Monolithic Ceramic Capacitors

Low ESL

● LLC18 (0306)

Part Number	Rated Voltage (Vdc)	TC	Capacitance	Thickness T (mm)
LLC185R71H222MA01L	50	X7R	2.2nF	0.5+/-0.1
LLC185R71H332MA01L	50	X7R	3.3nF	0.5+/-0.1
LLC185R71H472MA01L	50	X7R	4.7nF	0.5+/-0.1
LLC185R71H472MA01L	50	X7R	5.6nF	0.5+/-0.1
LLC185R71E682MA01L	25	X7R	6.8nF	0.5+/-0.1
LLC185R71E103MA01L	25	X7R	10nF	0.5+/-0.1
LLC185R71E153MA01L	25	X7R	15nF	0.5+/-0.1
LLC185R71E223MA01L	25	X7R	22nF	0.5+/-0.1
LLC185R71C103MA01L	16	X7R	10nF	0.5+/-0.1
LLC185R71C153MA01L	16	X7R	15nF	0.5+/-0.1
LLC185R71C223MA01L	16	X7R	22nF	0.5+/-0.1
LLC185R71C333MA01L	16	X7R	33nF	0.5+/-0.1
LLC185R71C473MA01L	16	X7R	47nF	0.5+/-0.1
LLC185R71C683MA01L	16	X7R	68nF	0.5+/-0.1
LLC185R71A104MA01L	10	X7R	0.1µF	0.5+/-0.1

● LLC185 (0306) Low profile

Part Number	Rated Voltage (Vdc)	TC	Capacitance	Thickness T (mm)
LLC185R71E103MA11L	25	X7R	10nF	0.5+0/-0.15
LLC185R71E153MA11L	25	X7R	15nF	0.5+0/-0.15
LLC185R71C103MA11L	16	X7R	10nF	0.5+0/-0.15
LLC185R71C153MA11L	16	X7R	15nF	0.5+0/-0.15
LLC185R71C223MA11L	16	X7R	22nF	0.5+0/-0.15
LLC185R71C333MA11L	16	X7R	33nF	0.5+0/-0.15
LLC185R71C473MA11L	16	X7R	47nF	0.5+0/-0.15
LLC185R71A563MA11L	10	X7R	56nF	0.5+0/-0.15
LLC185R71A683MA11L	10	X7R	68nF	0.5+0/-0.15
LLC185R71A104MA11L	10	X7R	0.1µF	0.5+0/-0.15

● LLC21 (0508)

Part Number	Rated Voltage (Vdc)	TC	Capacitance	Thickness T (mm)
LLC216R71H472MA01L	50	X7R	4.7nF	0.6+/-0.1
LLC216R71H682MA01L	50	X7R	6.8nF	0.6+/-0.1
LLC216R71H103MA01L	50	X7R	10nF	0.6+/-0.1
LLC216R71H153MA01L	50	X7R	15nF	0.6+/-0.1
LLC216R71H223MA01L	50	X7R	22nF	0.6+/-0.1
LLC219R71H333MA01L	50	X7R	33nF	0.85+/-0.1
LLC216R71E223MA01L	25	X7R	22nF	0.6+/-0.1
LLC219R71E333MA01L	25	X7R	33nF	0.85+/-0.1
LLC219R71E473MA01L	25	X7R	47nF	0.85+/-0.1
LLC219R71E683MA01L	25	X7R	68nF	0.85+/-0.1
LLC219R71E104MA01L	25	X7R	0.1μF	0.85+/-0.1
LLC219R71E154MA01L	25	X7R	0.15μF	0.85+/-0.1
LLC216R71C333MA01L	16	X7R	33nF	0.6+/-0.1
LLC216R71C473MA01L	16	X7R	47nF	0.6+/-0.1
LLC216R71C683MA01L	16	X7R	68nF	0.6+/-0.1
LLC219R71C104MA01L	16	X7R	0.1μF	0.85+/-0.1
LLC219R71C154MA01L	16	X7R	0.15μF	0.85+/-0.1
LLC219R71C224MA01L	16	X7R	0.22μF	0.85+/-0.1
LLC216R71A224MA01L	10	X7R	0.22μF	0.6+/-0.1
LLC216R71A334MA01L	10	X7R	0.33μF	0.6+/-0.1
LLC219R71A474MA01L	10	X7R	0.47μF	0.85+/-0.1

● LLC215 (0508) Low profile

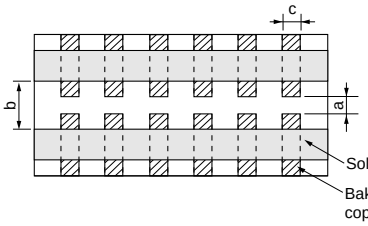
Part Number	Rated Voltage (Vdc)	TC	Capacitance	Thickness T (mm)
LLC215R71H682MA11L	50	X7R	6.8nF	0.5+0/-0.15
LLC215R71H103MA11L	50	X7R	10nF	0.5+0/-0.15
LLC215R71H153MA11L	50	X7R	15nF	0.5+0/-0.15
LLC215R71E103MA11L	25	X7R	10nF	0.5+0/-0.15
LLC215R71E153MA11L	25	X7R	15nF	0.5+0/-0.15
LLC215R71E223MA11L	25	X7R	22nF	0.5+0/-0.15
LLC215R71E333MA11L	25	X7R	33nF	0.5+0/-0.15
LLC215R71C153MA11L	16	X7R	15nF	0.5+0/-0.15
LLC215R71C223MA11L	16	X7R	22nF	0.5+0/-0.15
LLC215R71C333MA11L	16	X7R	33nF	0.5+0/-0.15
LLC215R71C473MA11L	16	X7R	47nF	0.5+0/-0.15
LLC215R71C683MA11L	16	X7R	68nF	0.5+0/-0.15
LLC215R71C104MA11L	16	X7R	0.1μF	0.5+0/-0.15
LLC215R71A154MA11L	10	X7R	0.15μF	0.5+0/-0.15
LLC215R71A224MA11L	10	X7R	0.22μF	0.5+0/-0.15
LLC215R71A334MA11L	10	X7R	0.33μF	0.5+0/-0.15

● LLC31 (0612)

Part Number	Rated Voltage (Vdc)	TC	Capacitance	Thickness T (mm)
LLC317R71H103MA01L	50	X7R	10nF	0.7+0.05/-0.1
LLC317R71H153MA01L	50	X7R	15nF	0.7+0.05/-0.1
LLC317R71H223MA01L	50	X7R	22nF	0.7+0.05/-0.1
LLC317R71H333MA01L	50	X7R	33nF	0.7+0.05/-0.1
LLC317R71H473MA01L	50	X7R	47nF	0.7+0.05/-0.1
LLC317R71H683MA01L	50	X7R	68nF	0.7+0.05/-0.1
LLC31MR71H104MA01L	50	X7R	0.1μF	1.15+/-0.1
LLC31MR71H154MA01L	50	X7R	0.15μF	1.15+/-0.1
LLC317R71E153MA01L	25	X7R	15nF	0.7+0.05/-0.1
LLC317R71E223MA01L	25	X7R	22nF	0.7+0.05/-0.1
LLC317R71E333MA01L	25	X7R	33nF	0.7+0.05/-0.1
LLC317R71E473MA01L	25	X7R	47nF	0.7+0.05/-0.1
LLC317R71E683MA01L	25	X7R	68nF	0.7+0.05/-0.1
LLC31MR71E104MA01L	25	X7R	0.1μF	1.15+/-0.1
LLC31MR71E154MA01L	25	X7R	0.15μF	1.15+/-0.1
LLC31MR71E224MA01L	25	X7R	0.22μF	1.15+/-0.1
LLC31MR71E334MA01L	25	X7R	0.33μF	1.15+/-0.1
LLC31MR71E474MA01L	25	X7R	0.47μF	1.15+/-0.1
LLC317R71C104MA01L	16	X7R	0.1μF	0.7+0.05/-0.1
LLC317R71C154MA01L	16	X7R	0.15μF	0.7+0.05/-0.1
LLC317R71C224MA01L	16	X7R	0.22μF	0.7+0.05/-0.1
LLC31MR71C334MA01L	16	X7R	0.33μF	1.15+/-0.1
LLC31MR71C474MA01L	16	X7R	0.47μF	1.15+/-0.1
LLC31MR71C684MA01L	16	X7R	0.68μF	1.15+/-0.1
LLC31MR71C105MA01L	16	X7R	1μF	1.15+/-0.1
LLC317R71A474MA01L	10	X7R	0.47μF	0.7+0.05/-0.1
LLC317R71A684MA01L	10	X7R	0.68μF	0.7+0.05/-0.1
LLC317R71A105MA01L	10	X7R	1μF	0.7+0.05/-0.1
LLC31MR71A155MA01L	10	X7R	1.5μF	1.15+/-0.1
LLC31MR71A225MA01L	10	X7R	2.2μF	1.15+/-0.1

● LLC315 (0612) Low profile

Part Number	Rated Voltage (Vdc)	TC	Capacitance	Thickness T (mm)
LLC315R71H103MA11L	50	X7R	10nF	0.5+0/-0.15
LLC315R71H153MA11L	50	X7R	15nF	0.5+0/-0.15
LLC315R71H223MA11L	50	X7R	22nF	0.5+0/-0.15
LLC315R71H333MA11L	50	X7R	33nF	0.5+0/-0.15
LLC315R71E153MA11L	25	X7R	15nF	0.5+0/-0.15
LLC315R71E223MA11L	25	X7R	22nF	0.5+0/-0.15
LLC315R71E333MA11L	25	X7R	33nF	0.5+0/-0.15
LLC315R71E473MA11L	25	X7R	47nF	0.5+0/-0.15
LLC315R71E683MA11L	25	X7R	68nF	0.5+0/-0.15
LLC315R71E104MA11L	25	X7R	0.1μF	0.5+0/-0.15
LLC315R71C223MA11L	16	X7R	22nF	0.5+0/-0.15
LLC315R71C333MA11L	16	X7R	33nF	0.5+0/-0.15
LLC315R71C473MA11L	16	X7R	47nF	0.5+0/-0.15
LLC315R71C683MA11L	16	X7R	68nF	0.5+0/-0.15
LLC315R71C104MA11L	16	X7R	0.1μF	0.5+0/-0.15
LLC315R71C154MA11L	16	X7R	0.15μF	0.5+0/-0.15
LLC315R71C224MA11L	16	X7R	0.22μF	0.5+0/-0.15
LLC315R71C334MA11L	16	X7R	0.33μF	0.5+0/-0.15
LLC315R71A474MA11L	10	X7R	0.47μF	0.5+0/-0.15
LLC315R71A684MA11L	10	X7R	0.68μF	0.5+0/-0.15

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>1</td><td colspan="2">Operating Temperature Range</td><td>R7 : −55℃ to +125℃</td><td></td></tr>
<tr><td>2</td><td colspan="2">Rated Voltage</td><td>See the previous pages.</td><td>The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.
When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P}, whichever is larger, should be maintained within the rated voltage range.</td></tr>
<tr><td>3</td><td colspan="2">Appearance</td><td>No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>4</td><td colspan="2">Dimensions</td><td>Within the specified dimension</td><td>Using calipers</td></tr>
<tr><td>5</td><td colspan="2">Dielectric Strength</td><td>No defects or abnormalities</td><td>No failure should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.</td></tr>
<tr><td>6</td><td colspan="2">Insulation Resistance (I.R.)</td><td>More than 10,000MΩ or 500Ω • F (Whichever is smaller)</td><td>The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25℃ and 75%RH max. and within 2 minutes of charging.</td></tr>
<tr><td>7</td><td colspan="2">Capacitance</td><td>Within the specified tolerance</td><td rowspan="2">The capacitance/D.F. should be measured at 25℃ at the frequency and voltage shown in the table.
<table><tr><th>Item \ Char.</th><th>R7</th></tr><tr><td>Frequency</td><td>1±0.1kHz</td></tr><tr><td>Voltage</td><td>1±0.2Vr.m.s.</td></tr></table></td></tr>
<tr><td>8</td><td colspan="2">Dissipation Factor (D.F.)</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V, 10V</th><th>6.3V</th></tr><tr><td>R7</td><td>0.025 max.</td><td>0.035 max.</td><td>0.05 max.</td></tr></table></td></tr>
<tr><td>9</td><td colspan="2">Capacitance Temperature Characteristics</td><td><table><tr><th>Char.</th><th>Temp. Range (℃)</th><th>Reference Temp.</th><th>Cap. Change.</th></tr><tr><td>R7</td><td>−55 to +125</td><td>25℃</td><td>Within±15%</td></tr></table></td><td>The ranges of capacitance change compared with the 25℃ value over the temperature ranges shown in the table should be within the specified ranges.
The capacitance change should be measured after 5 min. at each specified temperature stage.</td></tr>
<tr><td>10</td><td colspan="2">Adhesive Strength of Termination</td><td>No removal of the terminations or other defect should occur.</td><td>Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1 using a eutectic solder. Then apply 10N* force in the direction of the arrow. *5N: LLC18
The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.
 

<table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>LLC18</td><td>0.3</td><td>1.2</td><td>2.0</td></tr><tr><td>LLC21</td><td>0.6</td><td>1.6</td><td>2.4</td></tr><tr><td>LLC31</td><td>1.0</td><td>3.0</td><td>3.7</td></tr></table>
(in mm)
Fig. 1</td></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="3">Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10).
The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute.
This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>D.F.</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V, 10V</th><th>6.3V</th></tr><tr><td>R7</td><td>0.025 max.</td><td>0.035 max.</td><td>0.05 max.</td></tr></table></td></tr>
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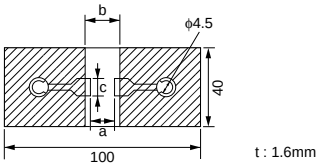
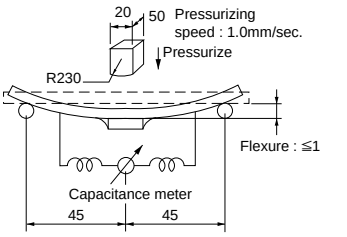
No.	Item		Specifications	Test Method
12	Deflection		No crack or marked defect should occur.  (in mm) Fig. 2	Solder the capacitor to the test jig (glass epoxy boards) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.  (in mm) Fig. 3
13	Solderability of Termination		75% of the terminations are to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5℃.
14	Resistance to Soldering Heat	Appearance	No defects or abnormalities	Preheat the capacitor at 120 to 150℃ for 1 minute. Immerse the capacitor in a eutectic solder solution at 270±5℃ for 10±0.5 seconds. Let sit at room temperature for 48±4 hours , then measure. •Initial measurement. Perform a heat treatment at 150 $^{+0}_{-10}$℃ for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.
		Capacitance Change	R7 : Within±7.5%	
		D.F.	Char. / 25V min. / 16V, 10V / 6.3V R7 / 0.025 max. / 0.035 max. / 0.05 max.	
		I.R.	More than 10,000MΩ or 500Ω • F (Whichever is smaller)	
		Dielectric Strength	No failure	
15	Temperature Cycle	Appearance	No defects or abnormalities	Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 48±4 hours at room temperature, then measure. Step / 1 / 2 / 3 / 4 Temp. (℃) / Min. Operating Temp. $^{+0}_{-3}$ / Room Temp. / Max. Operating Temp. $^{+3}_{-0}$ / Room Temp. Time (min.) / 30±3 / 2 to 3 / 30±3 / 2 to 3 •Initial measurement. Perform a heat treatment at 150 $^{+0}_{-10}$℃ for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.
		Capacitance Change	R7 : Within±7.5%	
		D.F.	Char. / 25V min. / 16V, 10V / 6.3V R7 / 0.025 max. / 0.035 max. / 0.05 max.	
		I.R.	More than 10,000MΩ or 500Ω • F (Whichever is smaller)	
		Dielectric Strength	No failure	
16	Humidity, Steady State	Appearance	No defects or abnormalities	Let the capacitor sit at 40±2℃ and 90 to 95% humidity for 500±12 hours. Remove and let sit for 48±4 hours at room temperature, then measure.
		Capacitance Change	R7 : Within±12.5%	
		D.F.	Char. / 25V min. / 16V, 10V / 6.3V R7 / 0.05 max. / 0.05 max. / 0.075 max.	
		I.R.	More than 1,000MΩ or 50Ω • F (Whichever is smaller)	
17	Humidity Load	Appearance	No defects or abnormalities	Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours. Remove and let sit for 48±4 hours at room temperature, then measure. The charge/discharge current is less than 50mA.
		Capacitance Change	R7 : Within±12.5%	
		D.F.	Char. / 25V min. / 16V, 10V / 6.3V R7 / 0.05 max. / 0.05 max. / 0.075 max.	
		I.R.	More than 500MΩ or 25Ω • F (Whichever is smaller)	
		Dielectric Strength	No failure	

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<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td rowspan="5">18</td><td rowspan="5">High Temperature Load</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="5">Apply 200% of the rated voltage for 1,000±12 hours at maximum operating temperature ±3℃. Let sit for 48±4 hours at room temperature, then measure.
The charge/discharge current is less than 50mA.

•Initial measurement.
Apply 200% of the rated DC voltage for one hour at the maximum operating temperature ±3℃.
Remove and let sit for 48±4 hours at room temperature.
Perform initial measurement.</td></tr>
<tr><td>Capacitance Change</td><td>R7 : Within±12.5%</td></tr>
<tr><td>D.F.</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V, 10V</th><th>6.3V</th></tr><tr><td>R7</td><td>0.05 max.</td><td>0.05 max.</td><td>0.075 max.</td></tr></table></td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ or 50Ω • F (Whichever is smaller)</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td></tr>
</table>